

Play behavior and the development of boldness and caution in juvenile ground squirrels

Madelene Shehan*, Scott Nunes



INTRODUCTION

- Play is a common behavior among juvenile mammals (Burghardt 2005) and can have important influences on their development (Beckoff and Byers 1998; Pellis et al. 2010; Kuczaj and Eskelinen 2014).
- Social play behavior may function to train young animals to cope with unexpected situations through influences on their emotional flexibility (Spinka et al. 2001).
- Temperament refers to behavioral tendencies of an individual that are repeatable over time or across contexts (Reale et al. 2007).
- Hurst-Hopf et al. (in prep) showed correlations between social play behavior in juvenile Belding's ground squirrels (*Urocitellus beldingi*) and the development of temperament measured in terms of docility.
- Expanding on the work done by Hurst-Hopf et al. (in prep), we evaluated the hypothesis that social play in juvenile *U. beldingi* influences the development of temperament, measured in terms of boldness and caution.



METHODS

- From May to July 2018, we studied a population of Belding's ground squirrels (*U. beldingi*) at Tioga Pass in the Sierra Nevada.
- At their first emergence from their natal burrow, juveniles were captured, weighed, tagged, uniquely marked, and released. Boldness of released juveniles was then measured via behavioral tests, which consisted of a researcher (the "intruder") walking toward a juvenile and noting his/her distance from the squirrel when the it first became aware of (noticed) the intruder and when the it fled from the intruder (Fig. 1).
- Play behavior in *U. beldingi* occurs primarily during the first two weeks that the juveniles are above ground (Nunes et al. 1999). Observation of the play bouts and the behavior of the juveniles were recorded during this period. Data, such as play duration, identity of play partners, and type of play were recorded for each play bout.
- We remeasured juveniles' boldness near the end of the juvenile play interval, 12-15 days following their first emergence from their natal burrows.

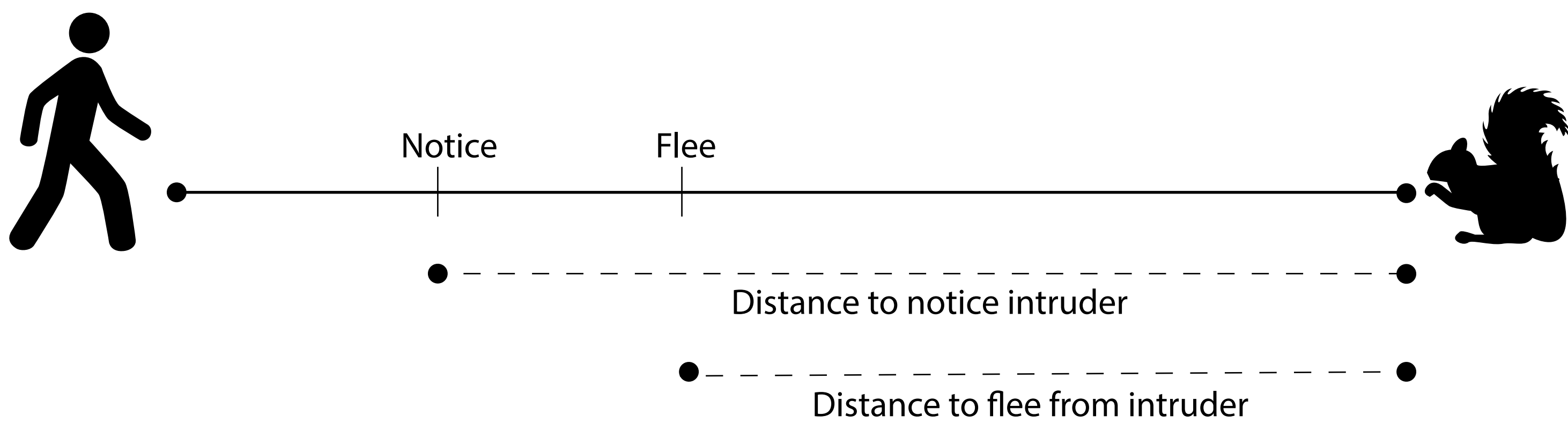


Figure 1. Set-up of behavioral tests to measure boldness in juvenile ground squirrels.

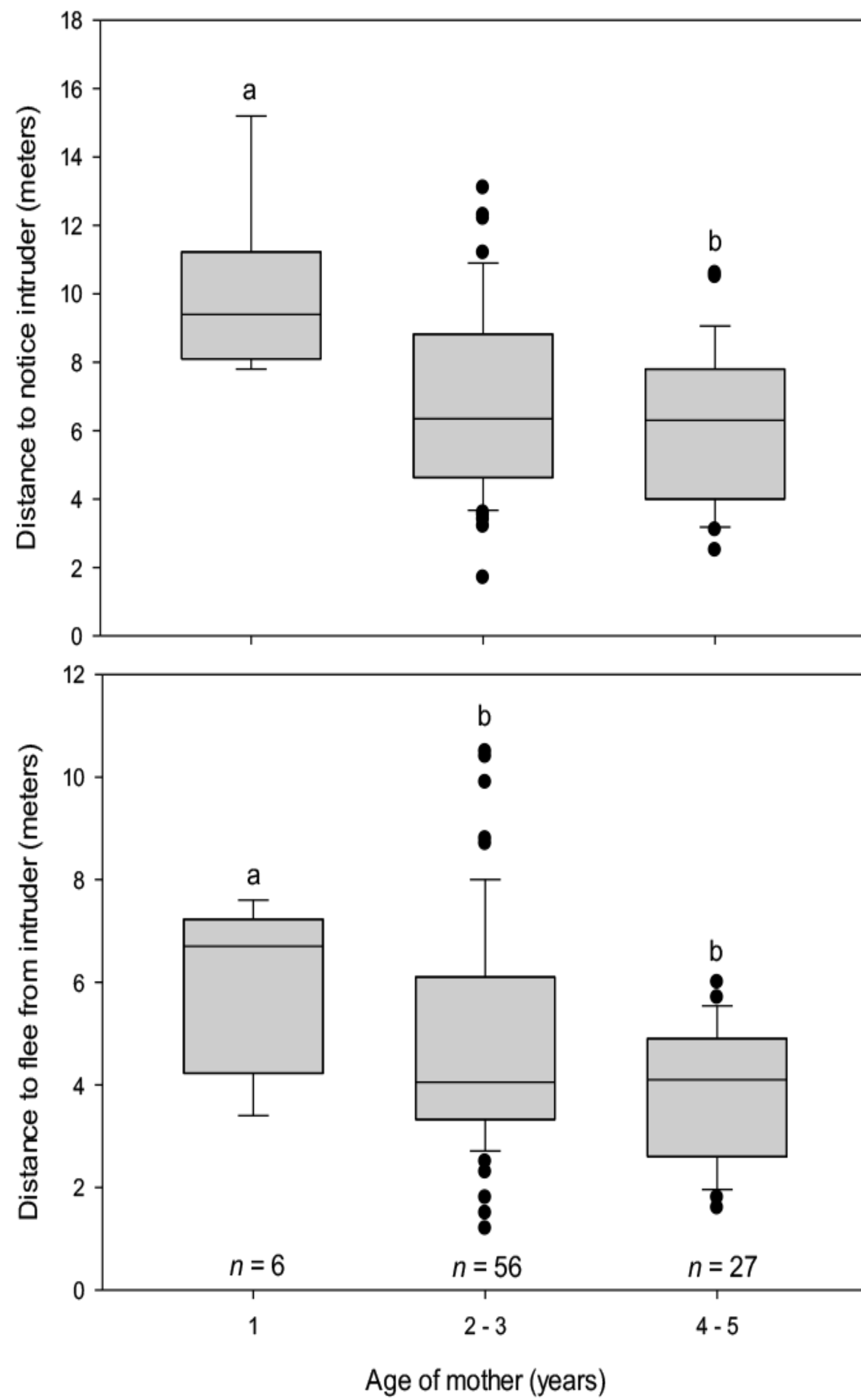


Figure 2. Relationship between mother's age and distances to notice (top) and flee (bottom) from an approaching human during behavioral tests conducted on juvenile ground squirrels to measure boldness.

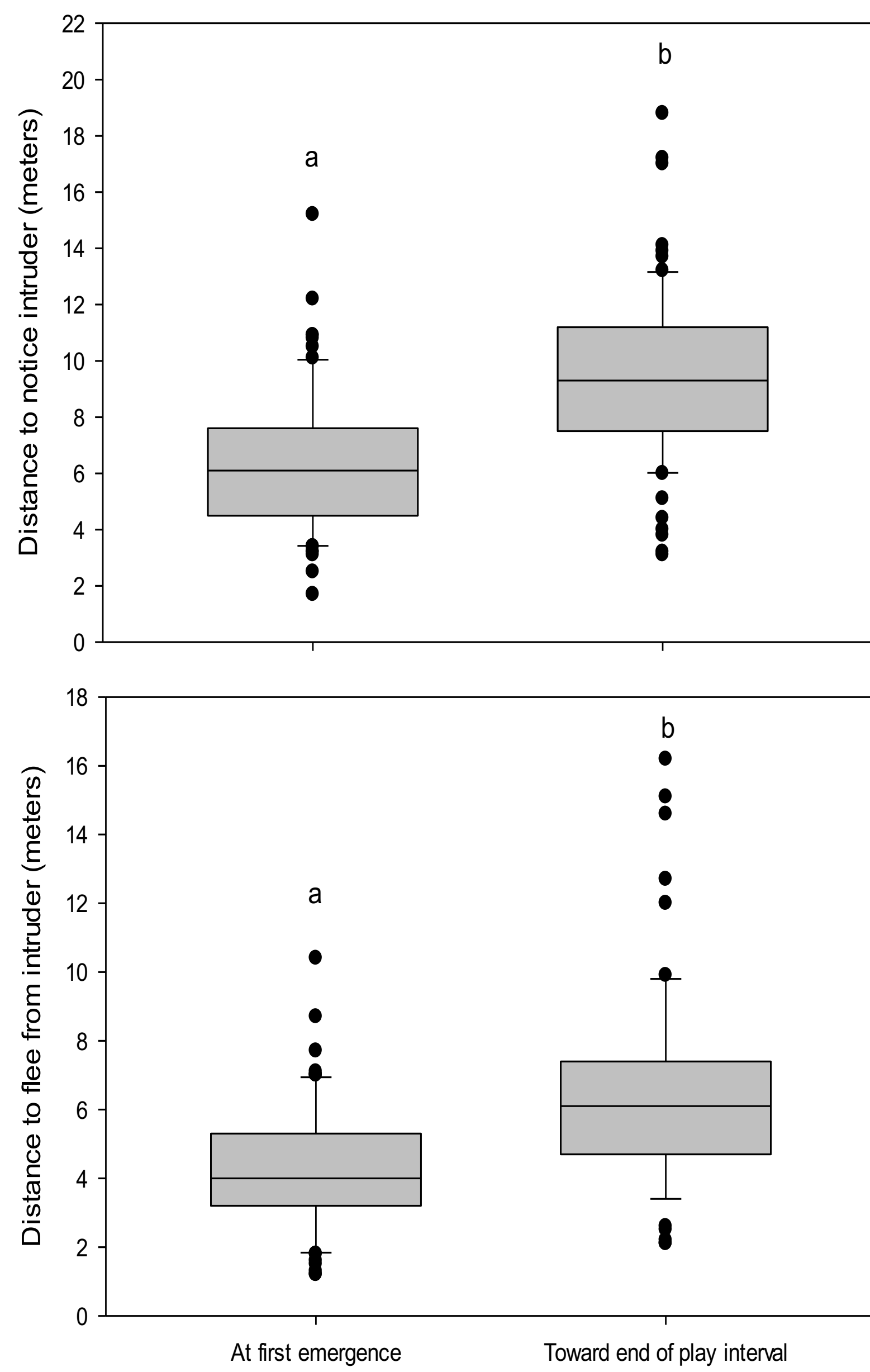


Figure 3. Change in distances to notice (top) and flee (bottom) from an approaching human during behavioral tests conducted on juvenile ground squirrels at the beginning and near the end of their juvenile play interval.

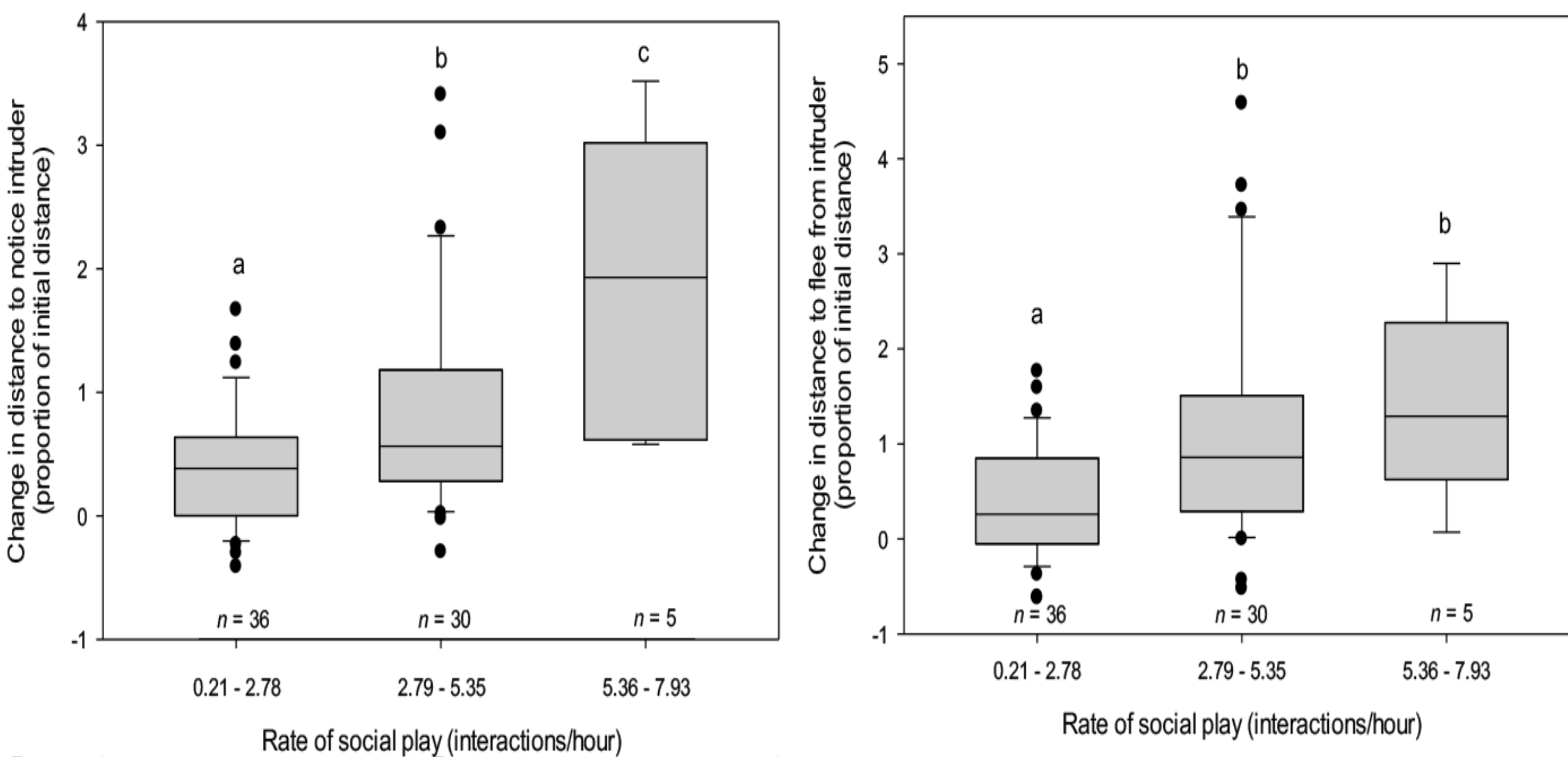


Figure 4. Relationship between rates of social play and change in distances to notice (left) and flee (right) from an approaching human during behavioral tests conducted on juvenile ground squirrels at the beginning and near the end of their juvenile play interval.

RESULTS

- The age of mothers was a significant predictor of the outcome of boldness tests at first emergence from the natal burrow. Juveniles with yearling mothers noticed ($F_{1,87} = 6.58, t = 2.57, P = 0.012$) and fled ($F_{1,87} = 6.01, t = 2.45, P = 0.016$) from intruders at greater distances than did juveniles with older mothers (Fig 2).
- Distances at which juveniles first noticed ($t_{70} = 8.10, P < 0.001$) and fled ($t_{70} = 6.85, P < 0.001$) from an intruder increased significantly over the play period (Fig 3).
- Rates of social play were significant predictors of increases in distances to notice ($F_{1,69} = 11.60, t = 3.41, P = 0.001$) and flee ($F_{1,69} = 12.22, t = 3.65, P = 0.001$) from an intruder. Juveniles who played at the highest rates had the greatest increases in the distance to notice and flee from an intruder (Fig. 4).

DISCUSSION

- Young of less experienced mothers were more cautious at their first emergence from the natal burrow than were juveniles with older, more experienced mothers, suggesting maternal influences on boldness and caution in juvenile *U. beldingi*. Mothers with less experience may be less proficient at providing care (Fleming et al. 1996), and young may respond with increased caution in behavioral responses.
- Caution in response to an intruder increased across the play interval. Elevated caution may be an adaptive response in young animals, allowing for earlier detection and evasion of potential threats.
- Juveniles who engaged in social play at the highest rates had the greatest increases in caution across the play interval. Social play has also been shown to increase boldness and exploration in unfamiliar environments (e.g. Marks et al. 2017). Thus, possible influences of play behavior on boldness and caution may vary with the context in which an animal finds itself.

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